



Kennedy Space Center
Materials Science Division



Materials Engineering and Failure Analysis

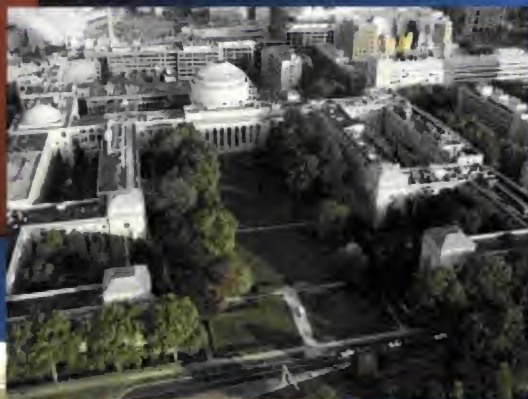
By Katherine Stone

Engineering and Technology Directorate (NE)
Materials Science Division (NE-L)



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The Basics



- Senior at Fort Walton Beach High School
- Dream School- MIT
- Mentor- Clara Wright
- Materials Engineering-Failure Analysis
 - Engineering and Technology Directorate
 - Materials Science Division





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NE-L Branches

L1: Failure Analysis



**L2: Materials Testing and
Corrosion Control**



L3: Prototype Development





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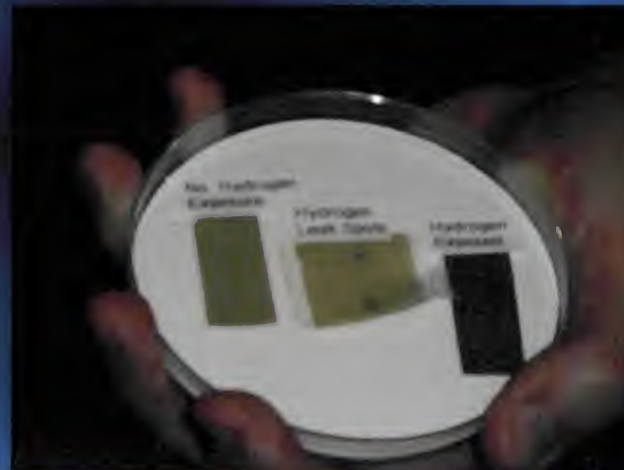
NE-L Branches Continued

**L4: Materials Processing and
Engineering**

L5: Applied Physics

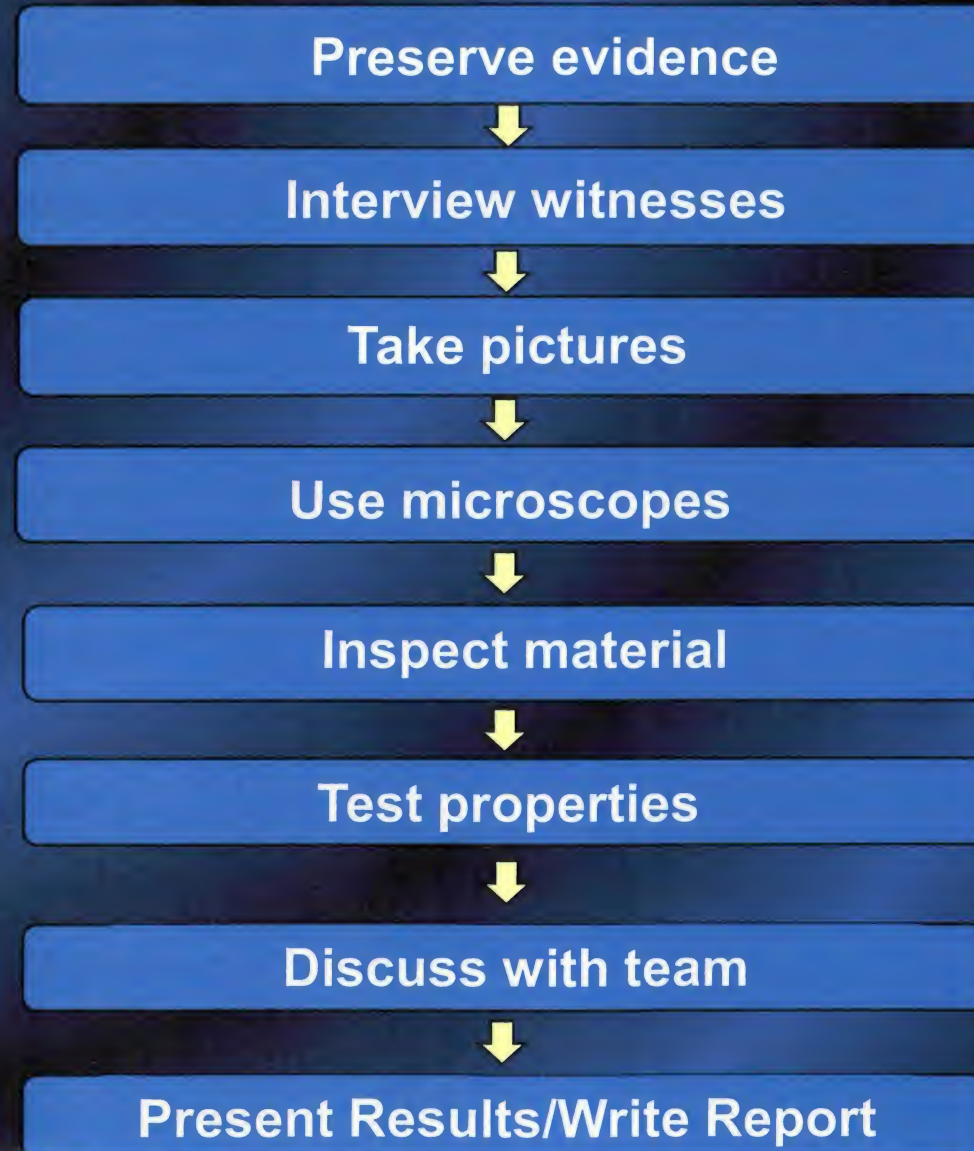


L6: Chemical Analysis





- Gathering
- Uploading and Organizing
- Future Statistical Analysis:
 - Determine common system failures in the shuttle program
 - Use this information to design future safety and inspection criteria

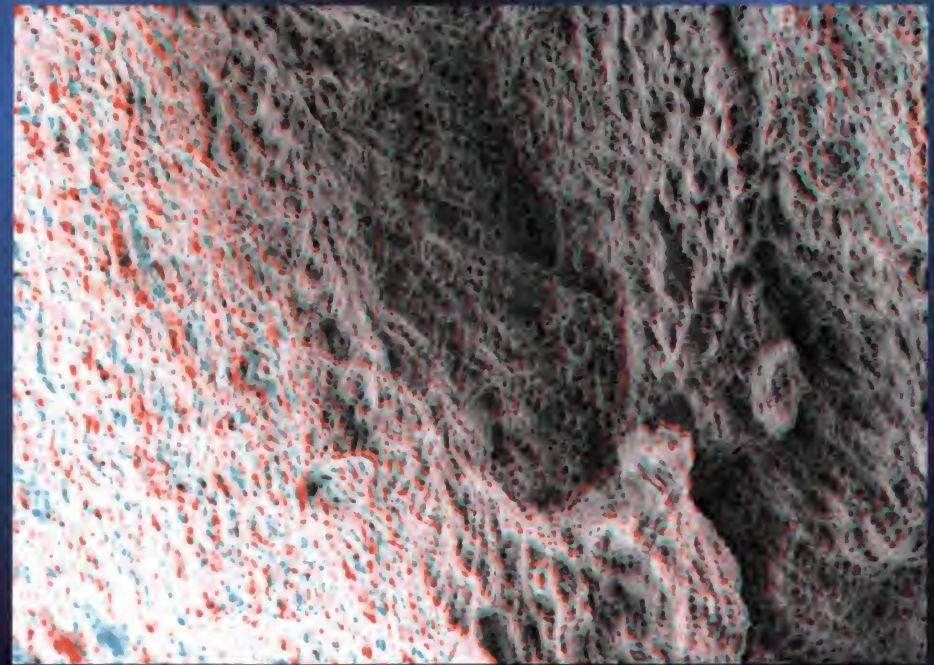




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Microscopy

- Keyence Digital Microscope
 - Up to 1,000x magnification
 - Qualitative 3D Imaging
 - View fracture surfaces and any abnormalities
- Laser Confocal Microscope
 - Quantitative 3D Imaging
- Scanning Electron Microscope (SEM)
 - 100,000x Magnification
 - Qualitative 3D imaging
 - Elemental Composition/Distribution
 - Helps determine mode of failure



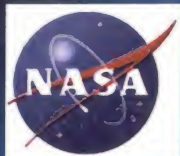


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Metrology

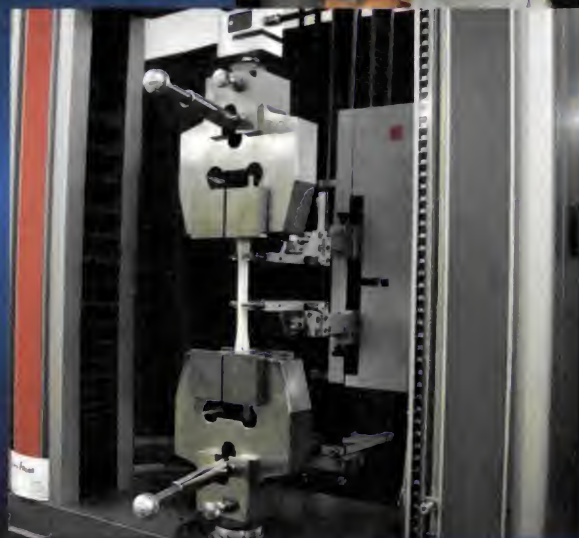
- Dimensional analysis to ensure hardware is fabricated to specifications
- Common Instruments:
 - Coordinate Measuring Machine (CMM)
 - accurate to 2/10,000 in
 - Programmable
 - 3-Dimensional Measurements
 - Keyence
 - Depth/ 3D Measurements
 - Micro-Vu
 - No physical touch
 - Accurate to 8/10,000 in (X-Y plane)
 - Easy to use





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Mechanical Testing



- Testing of material properties to ensure a material is processed correctly
- Common Tests:
 - Hardness Testing
 - Conductivity Testing
 - Tensile Testing
 - Determine/confirm ductility and tensile strength of a material using stress-strain curves
 - “Be-all-end-all” strength test



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Other Experiences

- NE-L Picnic
 - I am not good at Corn Toss
- Other Tours:
 - Shuttle design and processing facilities (VAB, OPF, Pad 39, etc.)
 - O&C High Bay (Orion Processing)
 - Cape Side/ Apollo, Mercury, and Gemini Facilities
 - Crew Quarters
- The Last Shuttle Launch
 - Pre-Launch Parties
 - Astronauts
 - Charles Bolden (on the dance floor)
 - Astronaut walk out from O&C
 - LCC with Beans and Corn Bread





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Influence on the Future

- Reinforced Materials Path
- Introduced me to failure analysis specifically
- Made contacts at MIT (My Dream School)
 - Gave me advice for admissions, course choices





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Special Thanks

- NASA INSPIRE
- Priscilla Moore, Angela Delp, Helen Kane
- Jim Gerard
- Steve Chance
- Samantha Rogers and Karesha Solomon
- Sharon Andre
- Clara Wright
- Dave Lubas
- Steve McDanel
- The Entire NE-L Division!